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June 28, 2013

Mr. Kevin M. Laberge, P.E.
Environmental Engineer III
Department of Fleet and Facility Management (2FM)
30 N. LaSalle St., Suite 300
Chicago, Illinois 60602-2575

Subject: Radiological Surface Gamma and Dose Rate Survey Results, Former Michael Reese Hospital Site, AECOM Project No. 60299817

Dear Mr. Laberge:

AECOM Technical Services, Inc. (AECOM) has prepared this letter report for the Department of Fleet and Facility Management (2FM) that summarizes the results of the surface gamma survey conducted in late April 2013 and a dose rate survey conducted on May 23, 2013. The gamma survey was performed on parcels of the former Michael Reese Hospital (referred to as "Site") located adjacent to and immediately north of E. 29th Street. The dose rate survey was conducted over a larger portion of the Site and encompassed parcels between E. 26th and E. 29th Streets.

Introduction

The Site currently consists predominantly of vegetation/soil covered, gravel/crushed concrete surfaces and paved surfaces (streets and sidewalks). Figure 1 presents an aerial photograph of the former Michael Reese Hospital and vicinity prior to the demolition of the above grade structures. Although the exact location of the former Carnotite Reduction Company remains unknown, historical information provided by the Illinois Emergency Management Agency (IEMA) suggested that in the early 1900's the former Carnotite Reduction Company operated in the vicinity of E. 26th Street and S. Ellis Avenue in Chicago, Illinois (formerly 2600 Inglehart Court).

A September 2012 a surface gamma survey was conducted by AECOM in an area that included S. Vernon and S. Ellis Avenues north of E. 29th Street as well as a relatively flat grass covered area west of S. Ellis Avenue (Figure 2 – Areas A & B). The September 2012 survey area is located immediately south of a larger area on which a surface gamma survey was conducted in December 2010 and January 2011.

In April 2013 2FM authorized AECOM to conduct a similar surface gamma survey east of S. Vernon and S. Ellis Avenues, north of E. 29th Street, south of E.27th Street and west of the Metra rail corridor. Like the prior surveys, this radiological surface survey was conducted to identify potential areas of elevated gamma readings that could be an indication of radiological contaminants at or near the ground surface. Since the September 2012 and April 2013 surveys were from adjacent areas they were combined and displayed together on one figure.

Survey Methods

The procedures and methods utilized for the surface survey follow those described in the November 18, 2010 work plan developed by AECOM and reviewed by the IEMA and the United States Environmental Protection Agency (USEPA). These methods were the same as those used to complete the survey at the Site in December 2010 and January 2011. Gamma radiation counts were measured using a Ludlum Model 2221 survey meter and an unshielded 2 x 2 inch Nal probe (Model 44-10). For the instruments used, the gamma count threshold equivalent to the 7.1 pCi/g total radium Streeterville clean-up value were 19,969 and 18,701 counts per minute (cpm) unshielded, respectively for the September 2012 and April 2013 surveys. Although a cleanup criteria value has not been approved for the Site, the USEPA cleanup value for Chicago's Streeterville area represents a means of quantifying the field readings of the instruments.

Surface readings were recorded continuously and logged at a 2 second interval along with a GPS coordinate as the operator traversed the investigation area. The individual traverses were spaced approximately 3 feet apart and generally parallel the boundaries of the screening area. During the surveys, the instrument probe was positioned as close as possible to the ground surface and generally about 2-inches above the ground. The data points collected during the surveys were reviewed individually (via histograms) and contoured using visualization software called Environmental Visualization System or EVS (by C-Tech Development Corp.).

In addition, AECOM conducted a dose rate survey at the former Michael Reese Hospital Site. Dose rate information, along with a one-minute surface gamma counts, were collected at each of forty-five (45) locations (refer to Figure 6). Specifically, data was collected within the area of known contamination as well as the areas outside of the area of known contamination. The dose rate data was collected with a Bicron MicroRem (serial No. C258C) calibrated on May 7, 2013. The Bicron MicroRem is a tissue-equivalent scintillator accurate for low level dose rate measurements.

Results

A cleanup criterion, and the equivalent field instrumentation threshold, for identification of potential contamination have not been established for the Site by the regulatory agencies. Until a cleanup criterion is established for the Site elevated gamma readings are defined as readings that exceeded twice the field instrumentation background as requested by the USEPA. Conservatively, gamma readings less than twice the field instrument background would generally not be considered as an indication of radiological contamination.

AECOM established two field survey instrument background values based on one-minute surface count data collected in September 2012 and April 2013. Specifically, data were collected to estimate a field instrument background value for paved surfaces as well as a second value for unpaved/grass covered areas. The location of the background areas is shown on Figure 3. Because the shielding ability of material increases with the density, the gamma readings taken over paved areas are expected to be lower. The combined field instrumentation readings varied only slightly over the respective surfaces, so the one minute count results were averaged to obtain the background value for each respective surface. The combined 2012 and 2013 field instrument background for paved surfaces was calculated as 5,034 cpm, while the vegetated surface background was calculated as 8,586 cpm.

A contour drawing of the combined (September 2012 and April 2013) surface gamma readings is presented in Figure 2. It should be recognized that surface gamma surveys are not able to detect subsurface radiological contamination buried at depth because soil and/or paving materials provide shielding. Thus, the deeper contamination is buried, the less likely a surface survey will be able to detect it. For soil covered areas, gamma surveys generally can detect low-activity contamination that is within 18-inches of the surface. Since the density of paving is greater than that of soil, the shielding created by

thicker pavement (i.e., 4-6 inches or more) may prevent the detection of low activity contamination just below the paved surface. From a human health perspective, the presence of paving prevents direct contact with the contamination; therefore contamination below paved surface does not generally represent an exposure concern, as long as the pavement remains in place.

The shading on the contour drawing (Figure 2) was set so that the color change from light green to yellow would occur at about twice the paved background value or 10,000 cpm. A review of Figure 3 clearly shows that the paved surface areas exhibited the lowest gamma counts, and as a result, are shaded in darker shades of blue. The survey data shows that the paved road surface is providing significant shielding of the underlying soil and the highest readings were observed in the unpaved areas at the edges of the roadways and sidewalks. The results of the September 2012 and April 2013 surveys did not detect the presence of elevated gamma reading above the paved surfaces (i.e., greater than twice background).

As expected, readings for soil and vegetated surfaces produced gamma counts slightly greater than those for paved areas. For vegetated surfaces, a color change from light blue to green occurs at approximately 9,000 cpm, which is essentially equivalent to the field instrument background value (8,586 cpm) for vegetated surfaces. The color scale displayed on Figure 2 does not include a value for twice the vegetated surface background because no gamma counts close to this value were observed in the survey. The maximum gamma readings observed in the September 2012 survey area were less than 13,000 cpm, while the April 2013 survey had a single data point over 13,000 cpm (i.e., 13,215 cpm). Both data sets had less than 1% of the gamma readings over 12,000 cpm. The highest gamma results were observed in the large vegetated area west of South Ellis Ave. As shown in Figure 2, no elevated gamma readings, as defined by twice background, were observed in either the September 2012 or the April 2013 surface surveys of the vegetated surface areas.

Data collected in the September 2012 survey were also tabulated and presented in a histogram in Figure 4, while the data for the April 2013 survey is displayed in Figure 5. The histograms show that the majority of the data is less than 8,000 counts per minute (cpm). The highest gamma reading observed in September 2012 was 12,971 cpm with an average of 7,235 cpm, while the maximum for the April 2013 data was 13,215 cpm with an average was 5,582 cpm. AECOM believes that the average for the April 2013 survey is less than that of the September 2012 survey because more of the survey area was covered with gravel or crusted concrete.

AECOM also collected 45 dose rate values at the Site (Figure 6). Seventeen (17) were collected within or immediately adjacent to the area of known contamination identified in the prior surface and down-hole surveys from December 2010, January 2011, and May 2011. An additional 28 values were collected from areas outside of the known area of contamination.

The majority of the dose rate values were collected from unpaved areas. Dose rates are expected to be slightly higher for unpaved areas because the paving provides appreciable shielding relative to soil. Furthermore, soil is likely to contain slightly higher concentrations of naturally occurring radioisotopes compared to paving materials.

The dose rate results for the areas outside of the area of known contamination ranged from 3 to 7 micro-rem/hr at the surface with an average of 4 micro-rem/hr (Table 1). These areas include the former park and playground area as well as the former building and parking lot areas immediately north of E. 29th Street. These dose rate values basically appear to be background.

In the area of known contamination previously identified, the dose rate values measured at the surface ranged from 3 to 55 micro-rem/hr with an average of about 13 microrem/hr (Table 2). The lowest value was recorded on the pavement in the street (low because the concrete provides shielding). The highest

dose rate was observed at location A-15 (refer to Figure 1). This was also the approximate area where the highest surface gamma results were observed during the original December 2010 and January 2011 surveys.

The Nuclear Regulatory Commission (NRC) public dose rate limits are 100 m-rem/yr (100,000 micro-rem/yr) and 2 milli-rem (2,000 micro-rem) in any one hour. With respect to the NRC limits, even the highest value is well below the NRC limit of 2 m-rem in any hour. With regard to the annual dose rate limit, an individual would have to spend essentially an entire work year (2080 hrs) at the highest recorded location in order to approach the 100 m-rem/yr limit. Since the area with the highest dose rate is small, it is not realistic to anticipate a scenario where the annual dose would be exceeded. In addition, this area is currently fenced and not accessible to the public.

A graph of the dose rate versus surface gamma data collected concurrently was also constructed (Figure 7). As expected, there is a very strong correlation between dose rates and gamma readings. Thus, the surface gamma results can be used to estimate dose rates. For example, surface gamma results less than 10,000 counts per minute (cpm) would have dose rates below 6 micro-rem/hr. Therefore, with the exception of the area of known contamination, the surface gamma survey information already collected can be used to infer that dose rates are at or near background values for all but a small portion of the former Michael Reese Hospital Site.

Conclusions

Cleanup criteria, and equivalent field instrumentation threshold, have not been established at this time for the Site. Therefore, elevated gamma readings have been conservatively defined as readings that exceed twice background. The field instrumentation surface gamma background value was calculated to be approximately 5,034 cpm for paved surfaces and 8,586 cpm for vegetated areas.

The twice background value for the paved areas is slightly greater than 10,068 cpm. Results from both the September 2012 and April 2013 surveys for the paved areas did not observe gamma readings greater than twice background in paved areas as shown in Figure 2. Gamma readings for the vegetated or soil covered surfaces were less than 13,000 cpm and substantially less than twice the background value for these surfaces. Thus, the gamma readings collected during the September 2012 and April 2013 surveys did not indicate results that would be indicative of surface or near-surface radiological contamination.

A primary goal of the September 2012 and April 2013 surface surveys was to determine if radiological contamination was present that could represent a potential human health exposure issue. The survey results did not observe readings that would be indicative of radiological contamination at or in the near-surface soil of the investigation area. Therefore, a radiological concern with surface soil in the survey areas is not present. Limitations of the Ludlum instrumentation surveys, especially shielding effects, limit the surface gamma screening technique to the upper 1.5-feet for soil and 1-foot or less for paved areas. Thus, conclusions regarding the absence of radiological contamination should not be extrapolated to soil beneath pavement or at depths greater than 1.5-feet below unpaved surfaces.

The dose rate results for the areas outside of the area of known contamination ranged from 3 to 7 micro-rem/hr at the surface and appear to be basically background for the area. These areas include the former park and playground area as well as the former building and parking lot areas north of E. 29th Street.

In the area of known contamination the dose rate values measured at the surface ranged from 3 to 55 micro-rem/hr with an average of 13 micro-rem/hr. The relatively small areas with the highest observed dose rate results were consistent with the surface gamma survey data observed during the original December 2010 and January 2011 surface surveys. Since these areas with the highest dose rate are small, it is not realistic to anticipate a scenario where the NRC's annual dose limit would be exceeded.

Closing

If you have questions, please do not hesitate to contact the undersigned. AECOM appreciates the opportunity to assist PBC with the surface radiological surveying activities.

Respectfully,

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Attachments
Tables 1 and 2 – Dose Rate Results
Figure 1 – Former Michael Reese Hospital Aerial
Figure 2 – Radiological Surface Results
Figure 3 – Radiological Surface Background Results
Figure 4 – Gamma Survey Histogram – September 2012
Figure 5 – Gamma Survey Histogram – April 2013
Figure 6 – Dose Rate Locations
Figure 7 – Dose Rate versus Surface Gamma

cc:

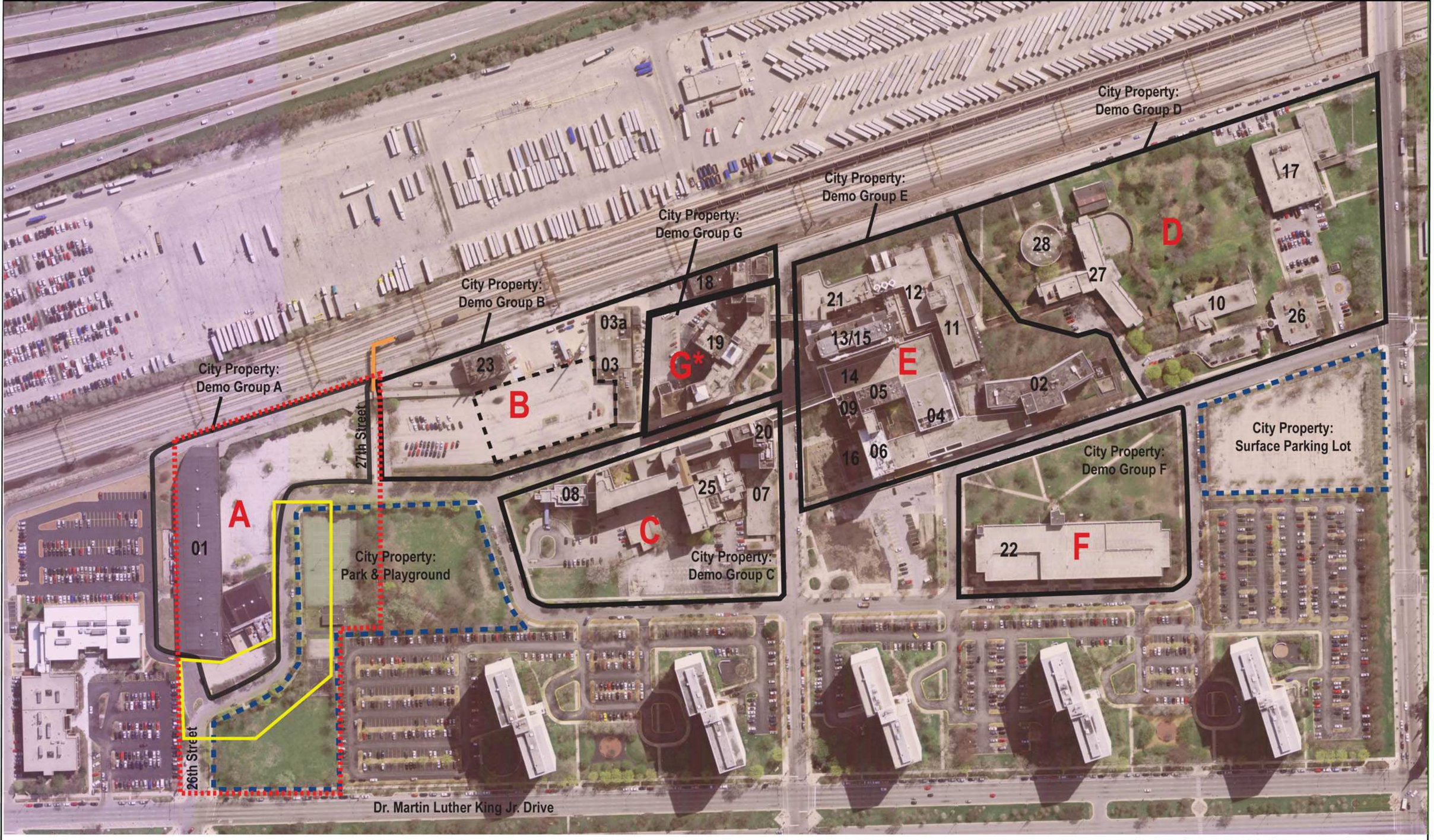
K. Worthington 2FM
M. Ames Dept. of Law

Table 1
Dose Rate Survey Results
Former Michael Reese Hospital
May 23, 2013

Location	Gamma (CPM)	Dose Rate (microrem/hr)		Surface Material
		Ground Surface	3-Feet Above Ground Surface	
B-1	4,556	3	2	Gravel
B-2	7,579	4	3	Grass
B-3	5,510	3	3	Grass
B-4	7,756	4	4	Gravel
B-5	10,614	7	4	Grass
C-1	7,723	5	4	Grass
C-2	7,137	4	3	Grass
C-3	6,456	4	4	Grass
C-4	7,517	4	3	Grass
C-5	4,959	3	3	Gravel
G-1	5,784	3	3	Gravel
G-2	4,042	3	3	Gravel
G-3	3,986	3	2	Gravel
P-1	8,462	5	3	Grass
P-2	5,503	3	3	Grass
P-3	9,166	5	4	Grass
P-4	7,875	6	4	Grass
P-5	11,417	6	5	Grass
P-6	9,280	6	5	Grass
P-7	7,395	4	3	Grass
P-8	7,141	5	3	Grass
P-9	6,503	4	4	Grass
P-10	8,071	4	3	Grass
P-11	8,227	4	4	Grass
P-12	8,239	4	3	Grass
P-13	7,395	4	4	Grass
P-14	6,463	3	3	Grass
P-15	7,905	4	3	Grass
Count	**28**	**28**	**28**	
Average	**7,238**	**4**	**3**	
Std. Dev.	**1,780**	**1**	**1**	
Maximum	**11,417**	**7**	**5**	

Table 2
Dose Rate Survey Results
Former Michael Reese Hospital - Area of Known Contamination
May 23, 2013

Location	Gamma (CPM)	Dose Rate (microrem/hr)		Surface Material
		Ground Surface	3-Feet Above Ground Surface	
A-1	26,649	18	12	Gravel ROW
A-2	7,774	4	4	Gravel ROW
A-3	10,116	6	4	Gravel ROW
A-4	8,083	5	4	Gravel ROW
A-5	14,294	8	6	Gravel ROW
A-6	49,118	30	17	Grass ROW
A-7	35,602	20	15	Grass ROW
A-8	18,815	13	8	Grass ROW
A-9	8,375	5	3	Grass ROW
A-10	8,419	5	4	Grass ROW
A-12	11,125	7	5	Grass ROW
A-11	6,181	3	3	Concrete Street
A-13	12,581	12	5	Grass ROW
A-14	9,902	6	5	Grass ROW
A-15	74,690	55	30	Grass
A-16	25,087	12	9	Grass
A-17	10,060	5	4	Grass
Count	**17**	**17**	**17**	
Average	**18,716**	**13**	**9**	
Std. Dev.	**18,375**	**13**	**7**	
Maximum	**74,690**	**55**	**30**	



1 HOSPITAL CAMPUS AERIAL IMAGE
SCALE: 1"=100'

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FIGURE 1

BUILDINGS:

01 - Administrative Services Center
02 - Baumgarten Pavilion
03 - Bensinger General Service Building
03a - Laundry Facility
04 - Blum Pavillion
05 - Cummings Research Pavilion
06 - Dreyfuss Research Labs
07 - Emergency Department/Entrance
08 - Florsheim Professional Building
09 - Florsheim Library
10 - Friend Pavilion
11 - Kaplan Pavilion
12 - Kaplan Surgical Wing
13 - Klein Women's Hospital
14 - KND Building
15 - Kunstader Children's Hospital
16 - Laz Chapman Pathology Institute
17 - Levinson Building
18 - Linear Accelerator
19 - Main Michael Reese Building
20 - Mandel Clinic/Emergency Room
21 - Meyer House
22 - Parking Structure
23 - Power Plant
25 - Rothschild Center
26 - Siegel Institute
27 - Singer Pavilion
28 - Wexler Pavilion

LEGEND

* Abatement Only
Metra Pedestrian Bridge
Building Groups
City Property
Surface Scan Property
Surface & Downhole Logging Boundary

BUILDING GROUP KEY: CITY PROPERTY

A= 01
B= 03, 03a, 18, 23
C= 07,08,20,25
D= 10,17,26,27,28
E= 02,04,05,06,09,11,12,13,14,15,16,21
F= 22
G*=19

PUBLIC BUILDING COMMISSION OF CHICAGO

Revision
Rev | Descriptions | Date | By
DRAFT | 04/13/09

Project Number:
Drawing File:
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Date:
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Project Title: MICHAEL REESE HOSPITAL
2929 S. ELLIS AVE. CHICAGO, IL 60616

Drawing Title: HOSPITAL CAMPUS AERIAL IMAGE

Drawing Number
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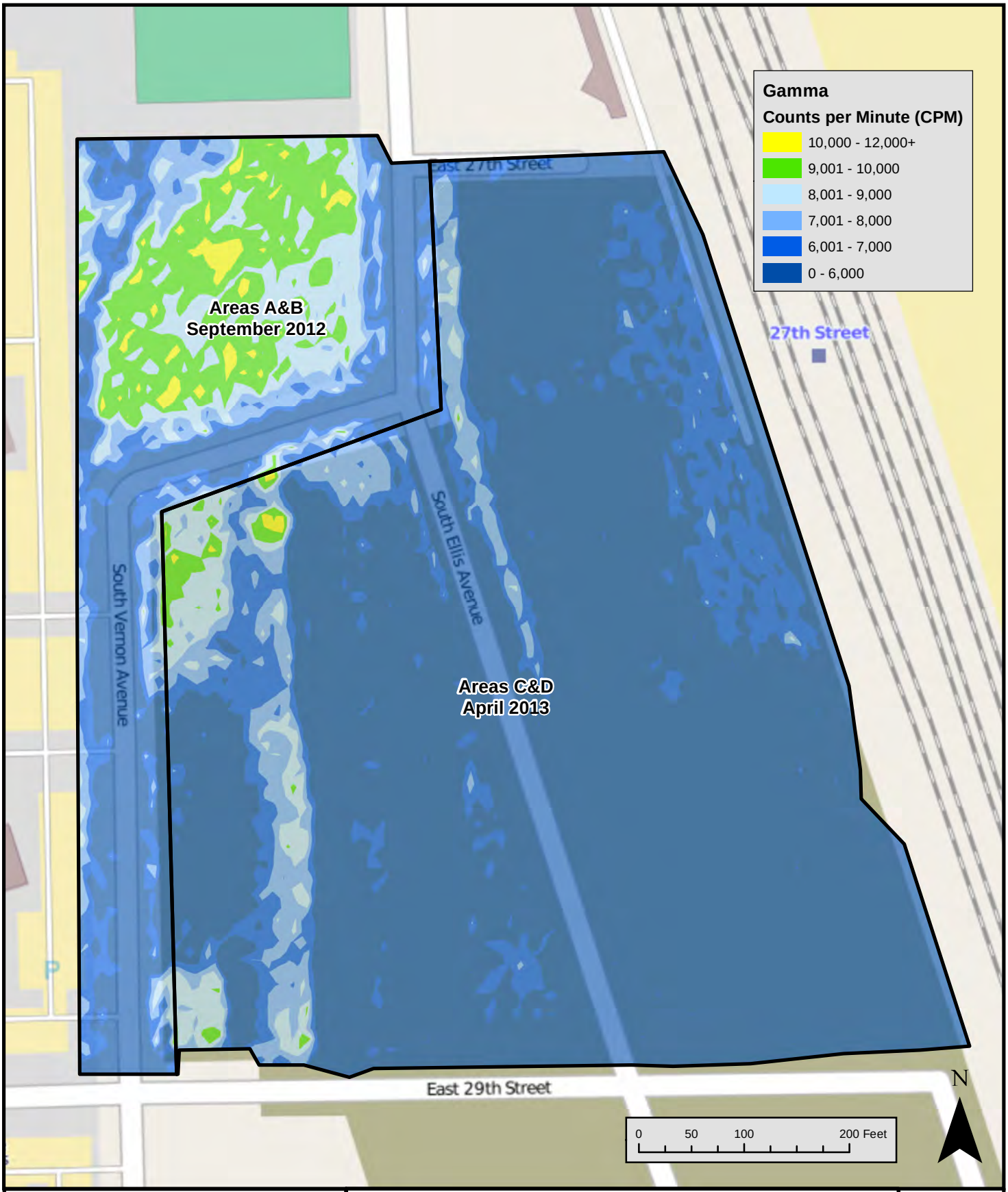

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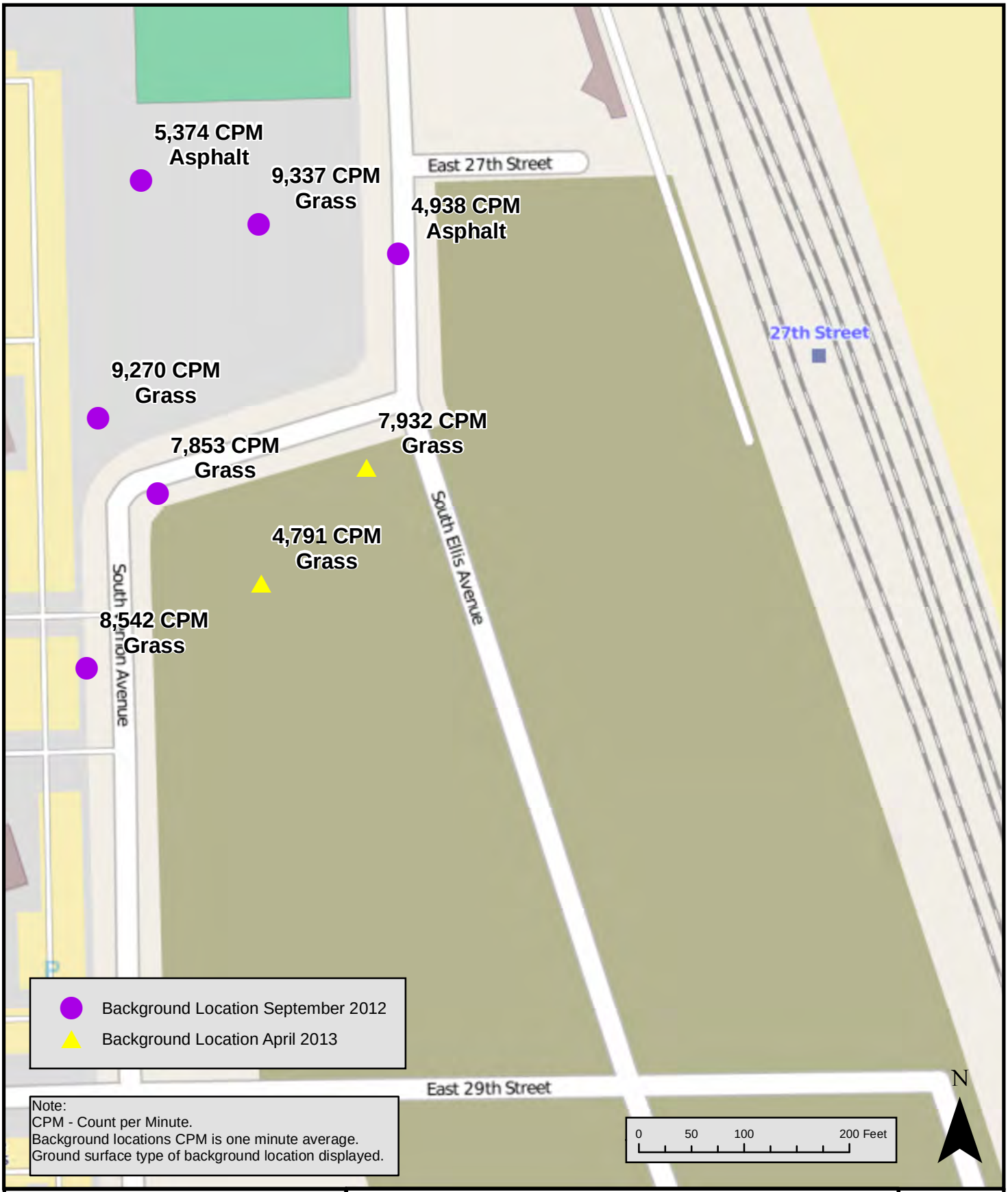
Preliminary Radiological Surface Screening Results

Former Michael Reese Hospital
Chicago, Illinois

FIGURE NUMBER:	DRAWN BY:	DATE:	PROJECT NUMBER:	SHEET NUMBER:
2	ML	May 15, 2013	60299817	1 of 1



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Background Radiological Surface Screening Results

Former Michael Reese Hospital
Chicago, Illinois

FIGURE NUMBER:
3

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ML	September 20, 2012	60158985.9	1 of 1

Figure 4
Gamma Survey Historgam Areas A and B
Vicinity of S. Ellis and S. Vernon Avenues Former Michael Reese Hospital - September 2012

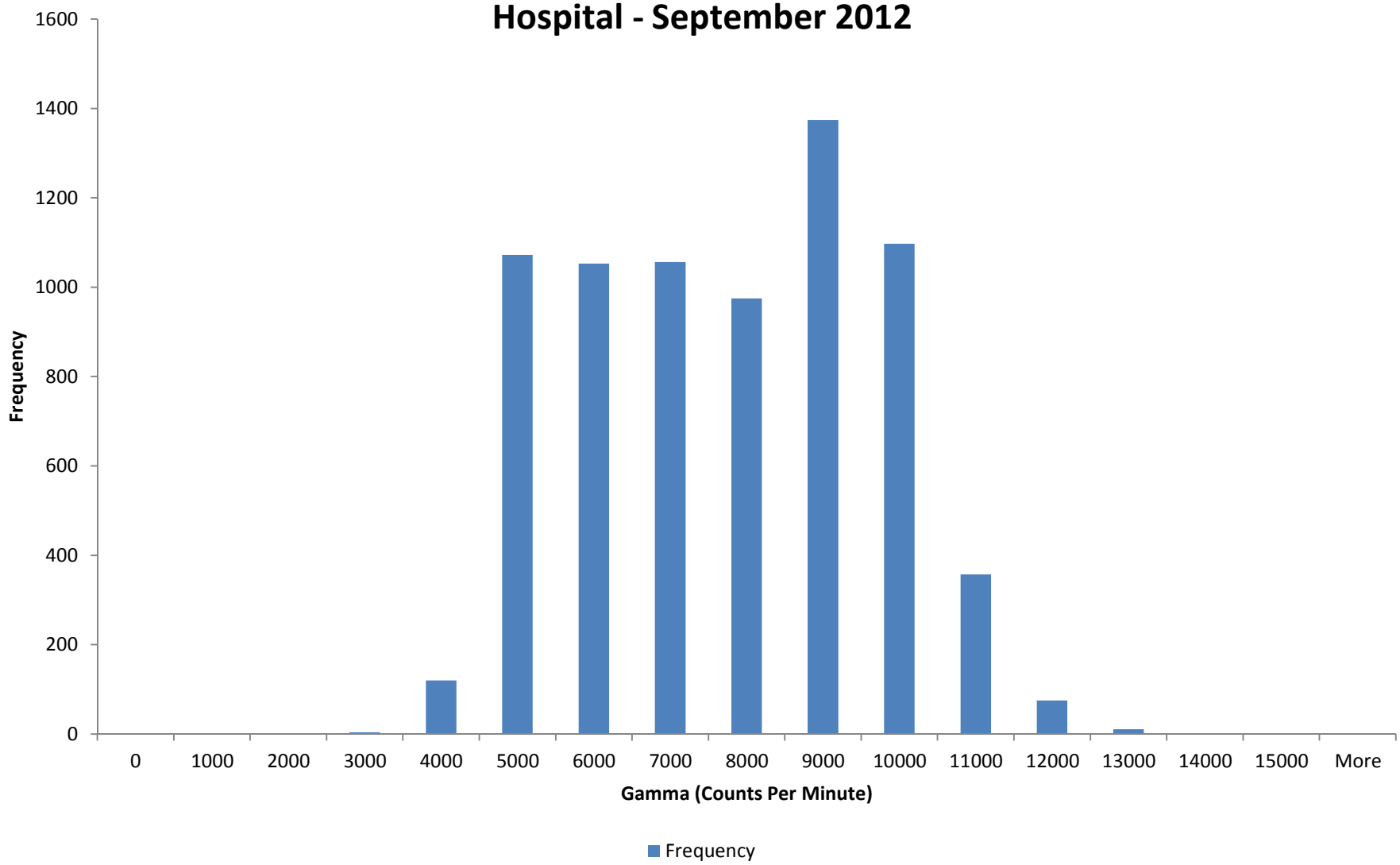

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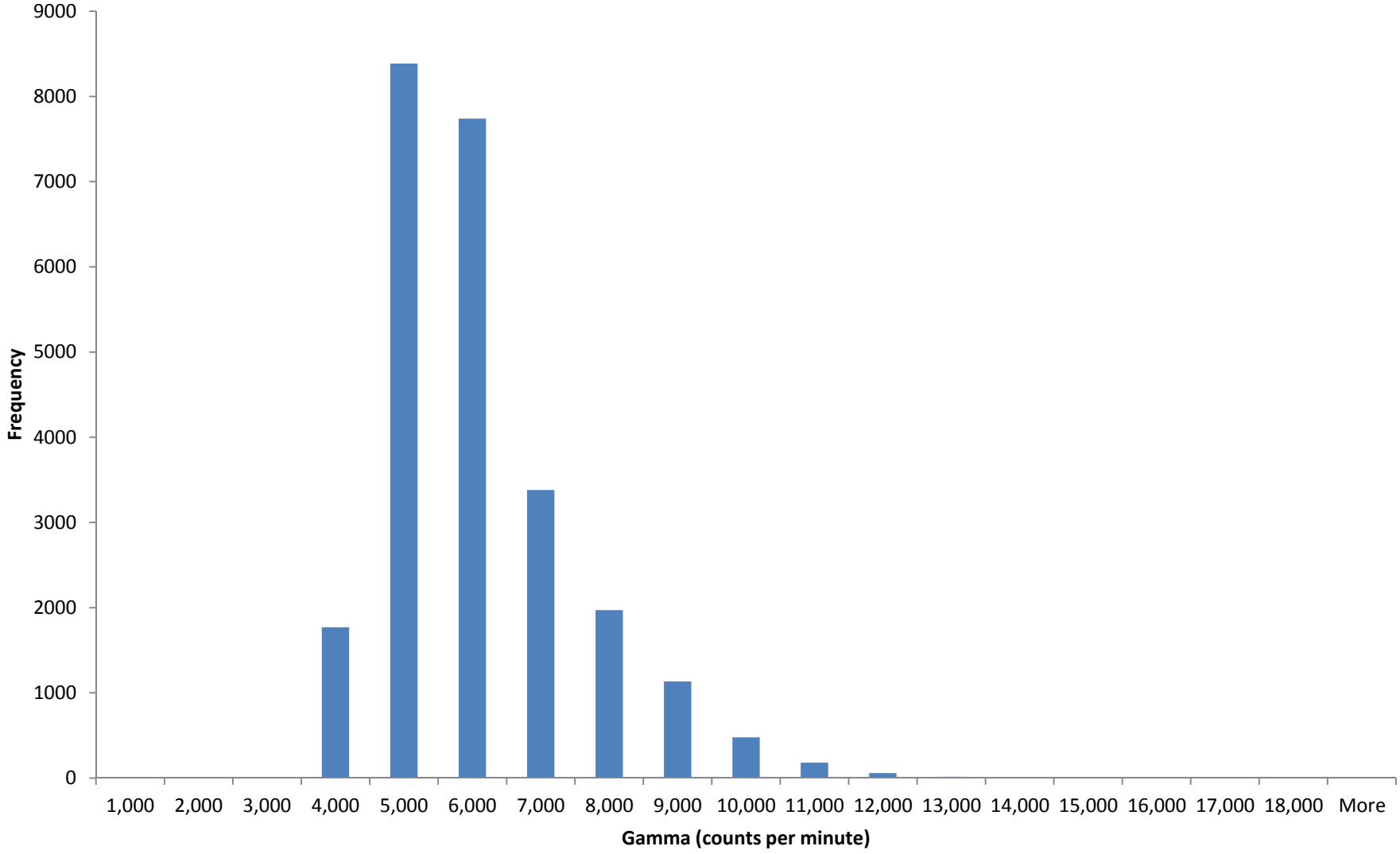
Figure 5
Gamma Survey Historgam - Areas C and D
Former Michael Reese Hospital - April 2013



File: U:\Cad_Drive_New\Michael Reese Hospital\Dose Rate Survey\Dose Rate Survey Locations.dwg Layout: ANSI_BVI-LJ User: garciaj Plotted: Jun 21, 2013 - 7:36am

Dose Rate Survey Locations May 23, 2013

Former Michael Reese Hospital
Chicago, Illinois

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PROJ. NO.: 60299817
DATE: 06/20/13

FIGURE NUMBER: 6
SHEET NUMBER: 1 of 1
REVISION: 0

NO	DRWN	DATE	REVISION	CHKD	DATE	APPVD	DATE
0	JG	06/20/13	Sample Location Update	SLK	06/20/13	SLK	06/20/13
1							
2							
3							
4							
5							
6							
7							

Figure 7
Surface Dose Rate Survey - May 23, 2013
Former Michael Reese Hospital Area